

Developing Tools for Improved Watershed Model Calibration

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Developing plans to remediate watersheds requires a sophisticated understanding of the degree to which multiple sources contribute contamination. Also of critical importance is an understanding of the relationship between contaminant loads and downstream impacts. Development of a watershed model can be an effective way to conceptualize the problem, hypothesize source/receptor relationships, and evaluate the relative effectiveness of alternative management solutions.

Hydrologic Simulation Program Fortran (HSPF) is a watershed model that is sufficiently detailed to assess whether waterbodies can and will meet water quality standards both before and after remediation. HSPF allows the user to simulate the fate and transport of a number of pollutants and pollutant types in the watershed environment. The WinHSPF implementation of the HSPF model, a component of the U.S. EPA's Better Assessment Science Integrating point and Nonpoint Sources (BASINS) modeling system, facilitates use of this complex model. BASINS and the WinHSPF interface support the population of model input parameters from national Geographic Information System (GIS) coverages and default parameters. In order to accurately describe the fate and transport of pollutants in a watershed, HSPF must be calibrated to minimize the mismatch between model output and monitoring data. While model setup has been greatly facilitated with the development of BASINS and WinHSPF, calibration represents a remaining significant bottleneck in the modeling process.

The U.S. Geological Survey (USGS) previously developed a tool to facilitate calibration of HSPF, the HSPF Expert System (HSPEXP). More recently, Watermark Numerical Computing developed a tool for parameter estimation (PEST). Both the U.S. EPA Office of Water (OW) and Office of Research and Development (ORD) had direct experience in applying this next-generation tool and saw its potential for not only speeding model calibration, but for better understanding and describing model predictive uncertainty. The U.S. EPA OW organized a workgroup, including Aqua Terra Consultants (ATC) (under contract to the OW), the USGS (both with long track records with calibrating HSPF), and Watermark Numerical Computing, who brought to the table a substantial piece of software that they had just recently made public domain.

The OW released the PEST feature in WinHSPF with the release of BASINS 3.1. This new feature will further help speed the development of model applications and thus make detailed assessments more affordable, along with improved quality and accuracy of these assessments. As model practitioners become more accustomed to automated calibration techniques, they will better understand the strengths and limits of their calibrated models and thus be able to provide better descriptions of model predictive uncertainty to decision-makers.